Space Weather Technical Forecast

Issued on Thursday, 07 July 2022 at 01:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Slight chance of R1-R2 radio blackouts. Chance of Minor Geomagnetic Storms. Increasing chance of Active fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low and there are currently seven sunspot regions on the visible disc, with the most complex being AR3053, Eko/Beta-Gamma which has rotated onto the northeast limb. The remaining regions are relatively small and stable. The C9.8 flare from AR3047 (which has now faded and no longer appears on current analysis) produced a Type II and IV radio burst along with a dimming in AIA211 on 5 July, and gave a very faint partial halo CME (Coronal Mass Ejection) in coronagraph imagery. This may give a glancing blow at Earth on Day 2 (8 July), although confidence is low. No other Earth-directed CMEs have been observed in available imagery over the past 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind, as observed at L1 by DSCOVR, has remained slow-ambient with a gradual decline from 350km/s to 320km/s, before the likely start of a CIR, ahead of the CH97/+ HSS. The density was mostly slightly above average, peaking at 21 ppcc at 06/0649UTC. The IMF was weak throughout and Bz varied weakly. The phi angle was predominantly positive (away from the sun). Geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES-16, remained at Background levels throughout the period. The high energy electron flux (greater than 2MeV) has also been at background levels through the last 24 hours. Electron fluence was well below the Active (1e8 integrated pfu) threshold. Observed fluence was 2.06e6 integrated pfu at 07/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is likely to be Low, with a Slight Chance of isolated M-class flares. An increase is probable through the period as returning regions potentially rotate onto the eastern limb.

Solar Wind / Geomagnetic Activity: Earth may experience a glancing blow from the CME which occurred at 05/0407 UTC from AR3047 (which has now faded). This CME was difficult to assess, however it gave a faint partial halo in SOHO imagery and as such a low confidence glancing blow is possible on Day 2 (8 July). Otherwise, solar winds are anticipated to become enhanced from slow-ambient slightly elevated levels as CH97/+ becomes geoeffective, most likely early on Day 1 (7 July) from the HSS or on Day 2 (8 July) from the possible CME, Geomagnetic activity starting Quiet may become Unsettled to Active with a Chance of G1/Minor Storm interval(s), these most likely on Days 1 and 2 (6 and 7 July) as the HSS arrives on Day 1 and the possible glancing blow from a CME on Day 2.

Energetic Particles / Solar Radiation: In the absence of any significant sunspot development,

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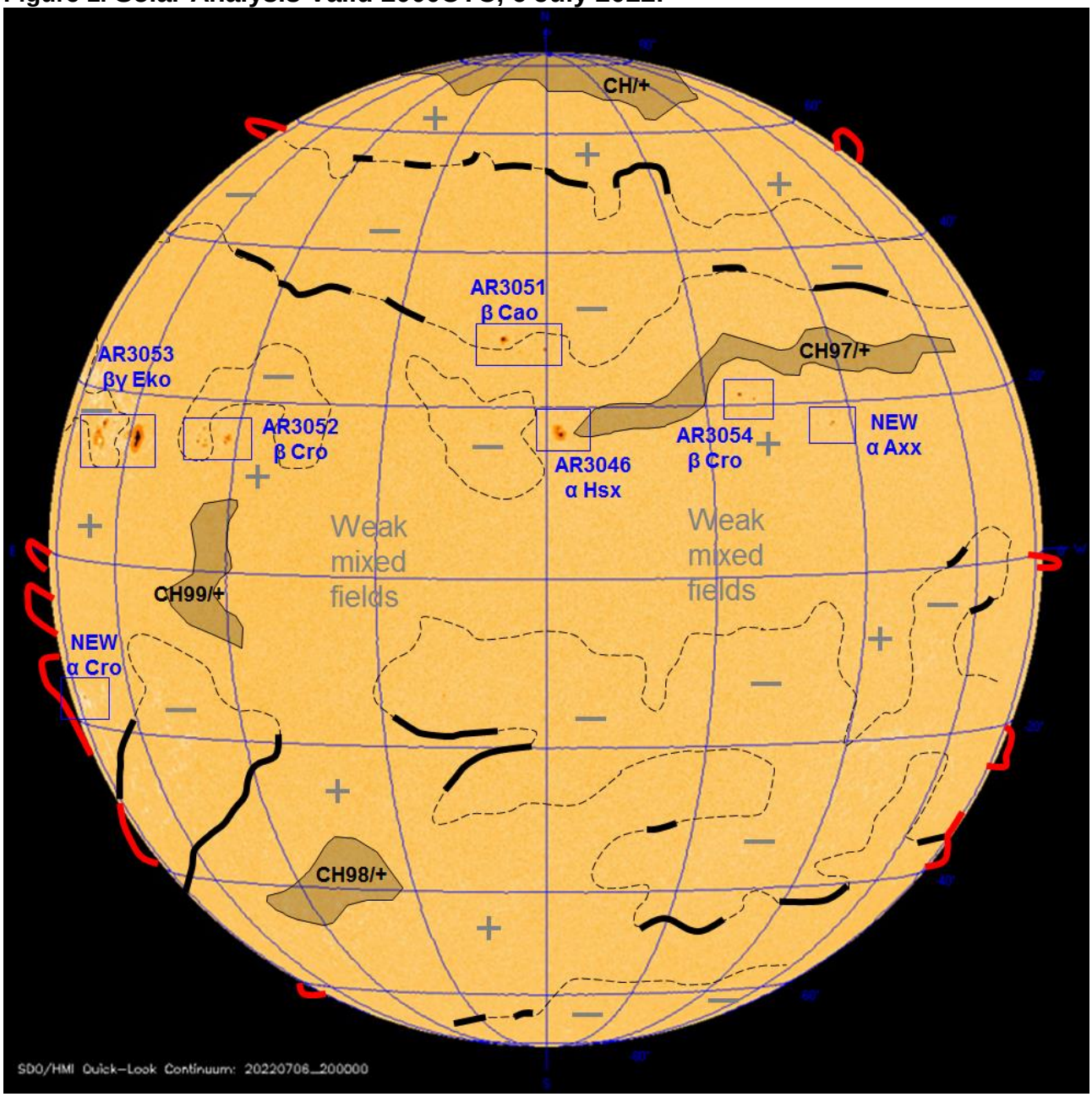
the high energy proton flux (greater than 10 MeV) is expected to remain at background levels.

High energy electron flux (greater than 2MeV) is currently at background levels. However, flux levels could become high during the diurnal maximum if the high speed stream influence occurs. Electron fluence is considered most likely to remain below the Active (1e8 integrated pfu) threshold throughout. Potential CME effects on Day 2 (8 July) may temporarily suppress electron levels however.

Figure 1. Solar Analysis Valid 2000UTC, 6 July 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Earth may experience a glancing blow from a CME which occurred at 05/0407 UTC from AR3047. This CME was difficult to assess as it was faint and contaminated by a far sided CME which was visible at the same time. However, it gave a faint partial halo in SOHO imagery and as such a low confidence glancing blow is possible on Day 2 (8 July).

Otherwise, solar winds are anticipated to become enhanced from slow-ambient to slightly elevated or possibly elevated levels as CH97/+ becomes geoeffective, most likely early on Day 1 (7 July). The longitudinal extent of this CH suggests that slightly elevated or elevated wind speeds could last for much of this period. Geomagnetic activity starting the forecast period at Quiet levels may become Unsettled to Active with an isolated G1/Minor Storm interval, this most likely on Days 1 and 2 (7 and 8 July) as the HSS arrives on Day 1 and the possible CME on Day 2.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
05/0934	Partial	AR3047	SW Quadrant	630 km/s	08/1200UTC	Low confidence – glancing blow possible

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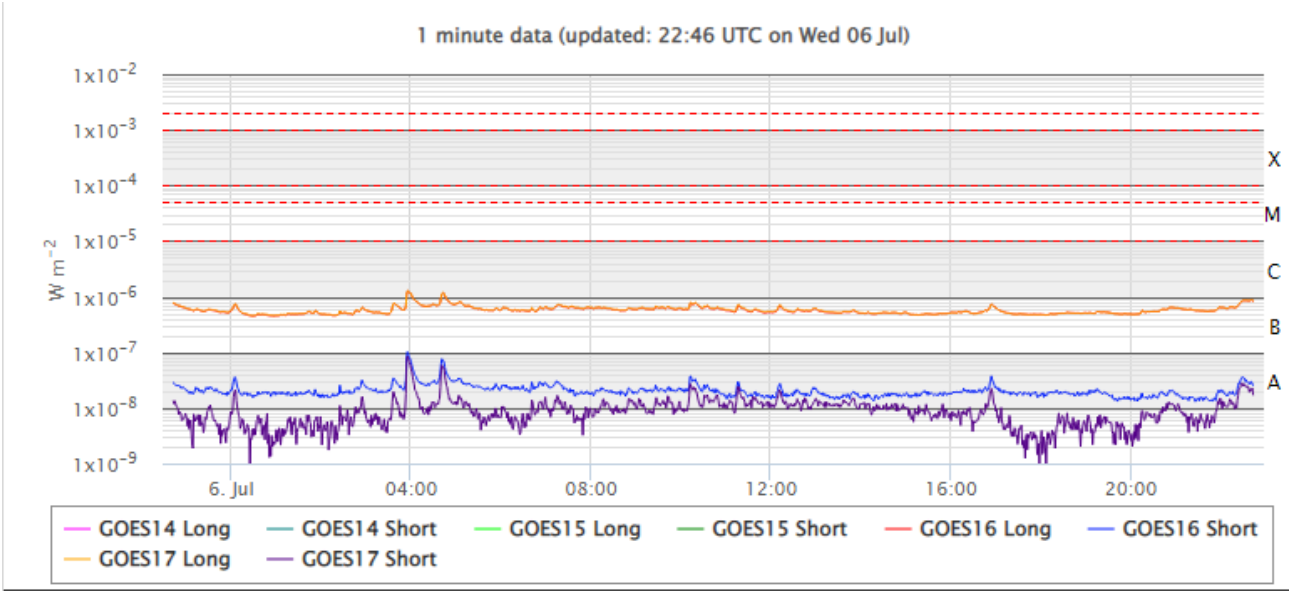
Radio Blackouts - X-Ray Flares:
There are currently seven sunspot regions on the visible disc, which might increase further in coming days, with potential returning sunspot groups due over the eastern limb and no groups of significance departing. The most interesting region currently visible is AR3053 (Eko/Beta-Gamma) in the northeast quadrant. The contribution from eastern limb arrivals (seen in far-sided imagery) is difficult to judge until they become visible, and probabilities have been kept flat for the next four days with a slight chance (20%) for an M-class flare each day.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	20	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: GOES X=ray flux plot showing minor C-class flares over past 24 hours.



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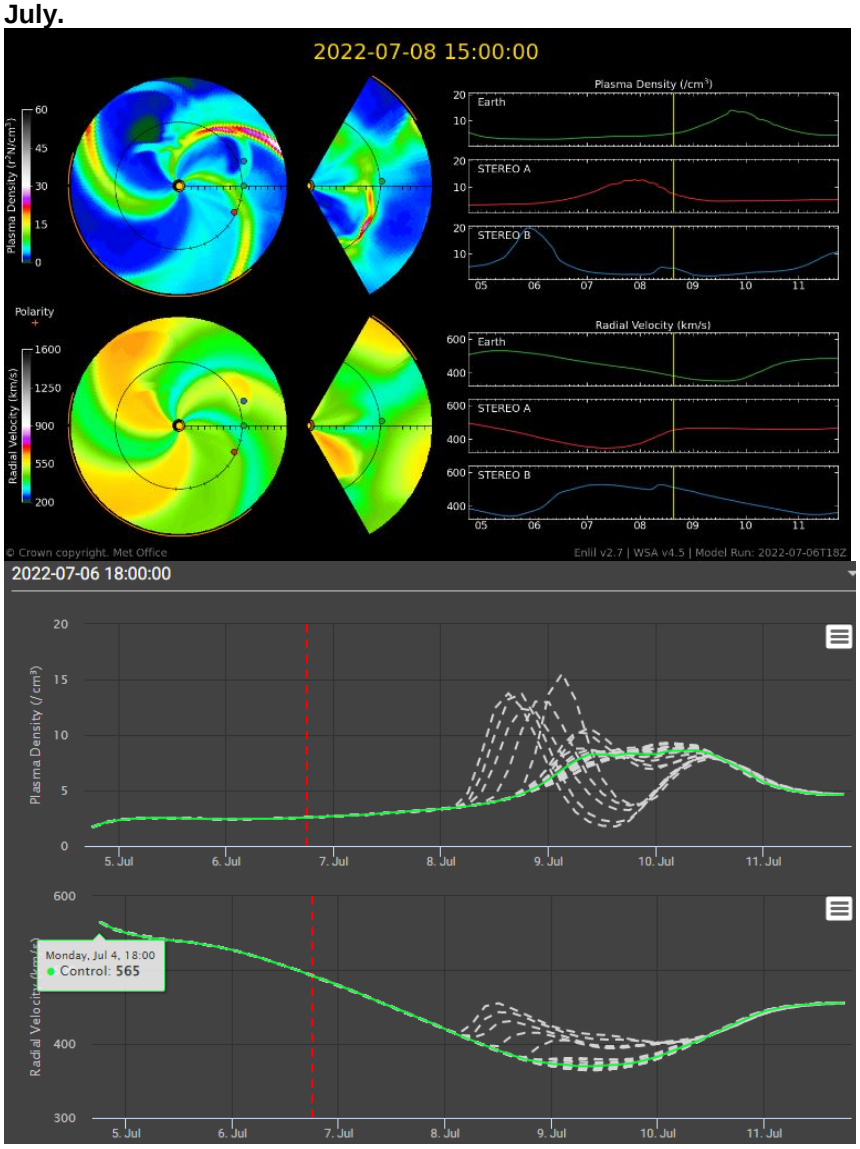
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) is currently at background levels, and will most likely remain at this level through the period, in the absence of any significant sunspot development. The main regions of interest are all in the eastern hemisphere at present.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	1	1	1	1
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: Met Office ENLIL output and ensemble data showing likely arrival times for the CME on 8 July.



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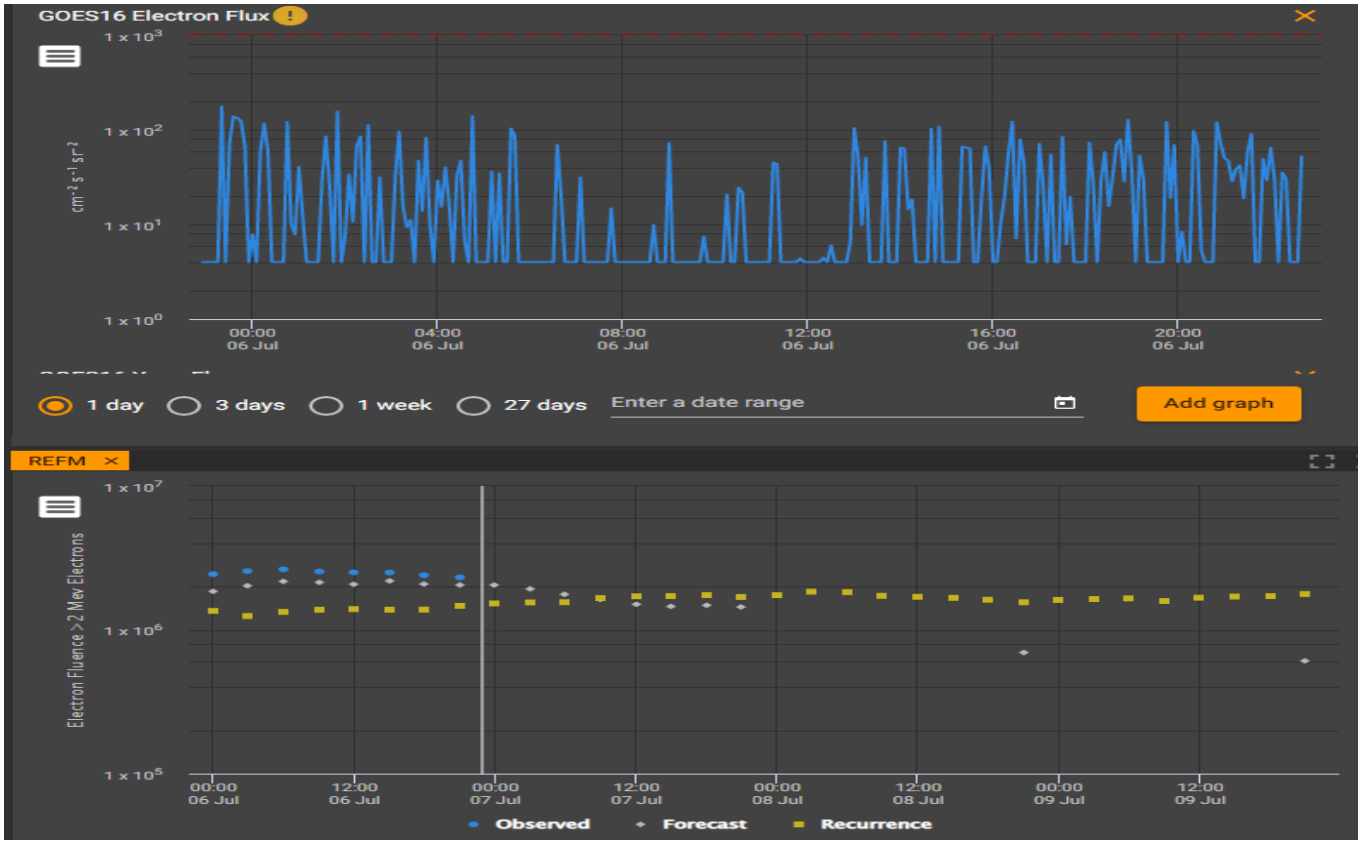
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV) is currently at background levels. Electron flux might increase through this period with anticipated elevated wind speeds from CH97. However, a low confidence CME glancing blow is possible early on Day 2 (8 July), which would temporarily suppress flux levels if it occurs. High (1000 pfu) flux levels might be reached during the diurnal maximum with some uncertainty due to the potential CME effects.

Electron fluence is currently well below the Active threshold. Fluence is considered most likely to remain below the Active threshold through the period, although this carries a degree of uncertainty due to the significant difference in coronal hole extent compared to the previous rotation and the possibility of CME effects. An upward trend is possible following any coronal hole connection but with low confidence for the magnitude of this. REFM output is currently considered to be giving good guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	10	10	20
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: High energy electron flux at GEO and Met Office REFM output.



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